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Supply Chain Analysis and Marketing Efficiency of Glass Eel Caught by Fyke Net (Gorong-Gorong) in Poso River Estuary, Central Sulawesi, Indonesia

Ivon Iskandar Mahi^{a*}, Mulyono Sumitro Baskoro^b, Sugeng Hari Wisudo^c,
Tri Wiji Nurani^d, Budy Wiryanawan^e

^a*Program of Marine Fisheries Technology, Postgraduate Programe, Bogor Agricultural University*

^a*Department of Fisheries Agribusiness, Faculty of Fisheries, Alkhairaat University (UNISA) Palu,
Central Sulawesi, 94221, Indonesia*

^{b,c,d,e}*Department of Fisheries Resources Utilization, Faculty of Fisheries and Marine Sciences,
Bogor Agricultural University 16680, Indonesia*

^a*Email: iim@unisapalu.ac.id*

^b*Email: baskoro.mul@gmail.com*

^c*Email: wisudo1966@gmail.com*

^d*Email: triwiji@hotmail.com*

^e*Email: bud@psp-ipb.org*

Abstract

Glass eel is a live product which is caught by fishermen using Fyke Net (Gorong-Gorong) at Poso River estuary, Poso Regency, Central Sulawesi Province, Indonesia. This study aims to analyze the supply chain and efficiency of glass eel's marketing chain. The method used in this research is case study method with qualitative approach which emphasizes on qualitative descriptive analysis. Data collection includes primary and secondary data. Primary data were collected through profound interview techniques with fishermen, local collector and provincial collectors. Secondary data were obtained from related institutions.

* Corresponding author.

Data analysis was performed by using qualitative descriptive analysis. The result showed that there are 2 (two) supply chain of glass eel, namely: (1) supply chain from fisherman to local collector merchant and then to consumer. In this supply chain, glass eel is distributed to South Sulawesi, West Sulawesi and Gorontalo; (2) supply chain from fisherman to local collector merchant to provincial collectors to collectors outside the province and to end consumers. In the second supply chain, glass eel is distributed to Jakarta, Surabaya, Makassar and Bali. Both supply chain in marketing efficient are categorized as inefficient because the fisherman's share value is less than the marketing margin ($FS < MP$). Marketing efficiency is categorized as efficient if the FS value is greater than MP ($FS > MP$).

Keywords: supply chain; efficient; market; fisherman; collector merchant; glass eel; consumer; poso.

1. Introduction

Eel (*Anguilla*, spp) is a unique fish that can live in three aquatic environments namely; sea water, brackish water and fresh water. The larvae lives in sea waters where the eggs hatch due to fertilization. In this state, the larvae (leptocephalus) lives in the sea waters. The larvae lives in the ocean and swept away by the current up to the estuary, thus migrating to Poso river as a glass eel. It grows into elver in the river and migrating to Poso Lake until reach adulthood. After being sexually mature, they begin their migration back to the sea to spawn.

Glass eel is already caught at the estuary of the Poso River. It is traded outside the Poso District as a living commodity. There are problems related to distribution process of this commodity from fishermen to end consumers (eel farmer). Eel distribution activities require research related to supply chain and marketing chain efficiency. The research related to supply chain and marketing efficiency of glass eel has not been performed in Indonesia.

Although Indonesia has a huge abundance of eel resources, however the local utilization rate (domestic) of this resources are still very low. One reason is that this fish has not been widely known in Indonesia, causing the most residents of Indonesia are not familiar to eat eel fish. Similarly, the utilization of this fish for export commodity purposes are still very limited [1]. Supply chain is a series of goods/physical flows, information and processes used to deliver products or services from source locations (suppliers) to the destination locations of either the customer or the buyer [17].

Marine and fishery products have different characteristics compared to other products such as fertilizer, cement or rice. This product has a short lifespan and high level of vulnerability to the weather so special handling is required in the packaging and distribution process in order to maintain the quality of the product. The distribution process of this products are closely related to supply chain management (SCM). The essence of SCM is the integration and collaboration in supply and demand management with all parties involved in business processes [3].

A supply chain consists of activities performed by multiple actors, thus the management is not an easy task to handle. The increasing complexity of the problem should be followed by proper consideration in managing the flow of products, finances and information within the overall supply chain environment, so that the process of

identifying actors in the supply chain or stakeholders and describing the functions, roles and relationships between players are needed [7]. In the supply chain there are regulatory systems related to product flow, information flow and financial flows. Understanding these arrangements are important due to the number of links involved in the supply chain of fisheries commodities as well as the characteristic of fisheries which is perishable compared to other commodity products [11]. Fishermen have an important role for supplying glass eel to the farmer. Intensive production still unable to cover all of the demand for eel's juvenile from eel farmer, so that it must be met by catching wild glass eel from the nature. Local collector merchants get glass eel supply from fishermen at the price they were agreed on. They do the purchasing, packaging and transportation of live glass eel to meet the demand from outside-provincial merchant or consumer. These process, transporting glass eel commodity from producer to consumer, is called supply chain. Supply chain involves several marketing actors, starting from the manufacturer to the end consumer. The supply chain reflects the fairness for all stakeholders in glass eel's distribution. Therefore, the study related to the fairness of glass eel's distribution process, the efficiency of glass eel's supply chain by considering the selling price factor in fisherman's level, the buying price and the selling price in collector merchant and the buying price in the consumer are needed to perform. To determine the efficiency of marketing supply chain, fishermen share (FS) and marketing margin (MP) are needed. Based on the above description, it is deemed necessary to do the research related to glass eel's supply chain and marketing efficiency in Poso District, Central Sulawesi Province, Indonesia.

2. Methods

2.1. Time and Locations

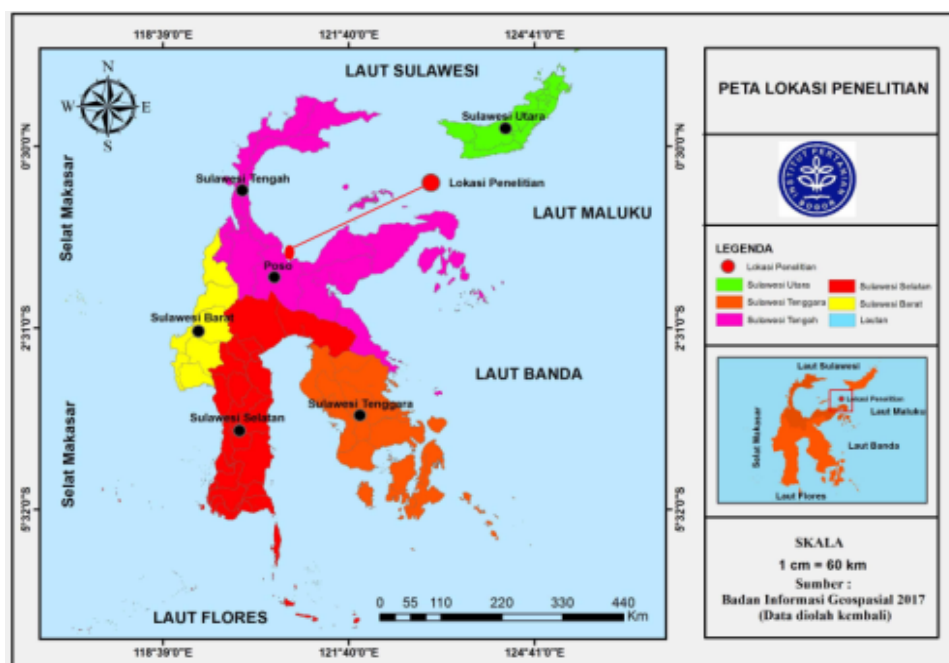


Figure 1: Research location at the estuary of Poso River, Poso.

This research was conducted from February 2015 to July 2015 at the estuary of Poso River, Poso Kota Utara, Poso District, Central Sulawesi Province, Indonesia. Poso River Basin is one of glass eel fishing area. This river has a watershed of $\pm 1101.87 \text{ km}^2$ with a length of $\pm 68.70 \text{ km}$ [8]. The potential existence of glass eel is quite large which is characterized by intense glass eel fishing activities in the river. This is seen in the catching activities which targeting not only when adult eels are migrating to the sea, but also the glass eel migrating to the lake [10]. Intensive fishing area of glass eel is important as the starting point of distribution or supply chain. Research location is presented in Figure 1.

2.2. Data Collection

This research was conducted by using case study method with qualitative approach, emphasized on explorative descriptive analysis. The case study method is a method that focuses on the facts which occur in society [14]. Data collection is done through profound interview technique with interviewees. Samples in qualitative research are not called respondents, but as interviewees or participants, informants, friends and teachers in the study [16]. Interviewees are including fishermen, local collector merchant and provincial collectors merchant. Primary data were obtained directly from the research location where the eel fishery activity is carried out by fisherman, local collector merchant and provincial collector merchant. Secondary data were obtained from government technical agencies in Poso District, Central Sulawesi Province.

2.3. Data Analysis

Data analysis were performed by using supply chain analysis through observations and descriptive analysis toward supply chain condition in Bonesompe Sub-district, Poso District, Central Sulawesi Province and other Province outside of Central Sulawesi. Supply chain analysis includes study on the distribution activity of glass eel catch from the estuary of Poso River to the consumers.

A marketing is said to be efficient if the farmer's share (FS) is greater than the marketing margin. FS can be obtained by comparing farmer-level price with consumer-level price [2]. If the value of the farmer's share is equal to the value of the marketing margin, then it is called neutral. If the value of a farmer's share is lower than the marketing margin, then the marketing it is called to be inefficient. In this study, the term of fisherman's share (FS) is used to replace the term of farmer's share. The value of fisherman's share is measured to find out the rate of share which can be obtained by fishermen at the consumer level.

Marketing efficiency of supply chain can be obtained by calculating market share and marketing margin. Fisherman's share (FS) is an approach to measure how much money that can be obtained by stakeholder from the share of the price at consumer level. [2] in [12] states that market share is calculated by using the formula below:

$$Sp = \frac{Pf}{Pr} 100 \% \dots\dots\dots (1)$$

Descriptions :

Sp = Share prices on fishermen

Pr = Prices on retailers

Pf = Prices on fishermen

The marketing margin shows the value gained from retailer's price minus the price on the fisherman's level. Marketing margins are calculated by the formula [2] :

$$M = Pr - Pf \quad \dots\dots\dots (2)$$

Descriptions :

M = Marketing margin

Pr = Price on retailers

Pf = Prices on fishermen

3. Result

3.1. General Condition of Research Location

Bonesompe is Sub-district in Poso District where a large river named Poso River flows through. Poso River Basin is one of the eels fishing areas with watershed of $\pm 1101,87 \text{ km}^2$ and a length of $\pm 68.70 \text{ km}$ [8]. Eel fishing activity in Poso river is quite intensive which can be seen in fishing activities which targeting not only adult eels when the fish are migrating to the sea, but also the glass eel leading to the lake [10].

3.1.1. Fisherman and Fishing Operation

Fishermen in the coastal area of Poso River estuary catch glass eel with fyke net. Fishing operation is performed at night by utilizing glass eel's behavior which actively foraging at night (nocturnal). Fishing operation are performed from the afternoon before the high tide until morning. Fyke net is a fishing gear installed on the river banks at 0.2 m - 1.5 m depth with position facing to the sea (Figure 2). The wings and the bag is plugged with iron rod to maintain the gear's positioned stretched and strong. Glass eel went into the fyke net along with the tide and difficult escape. Glass eels are collected in the morning by opening a bag on the tail of fyke net (cod end). This bag is a container for glass eels that are trapped inside. The catch will then be transferred to a net which planted on the Poso riverside under the fisherman's stilt house.



Figure 2: Fyke Net (Gorong-Gorong)

3.1.2. Packaging

There are several treatments given to glass eel before distributed to end consumer. Glass eel should be packed in plastic bags filled with water as well as small plastic bag of ice and oxygen at 18 °C in . One plastic bag was containing 0.5 kg (2500-3000 individuals) of glass eel. Three plastic bags filled with small plastic bags containing ice with 0.5 kg weight were inserted into a styrofoam box. An SUV or van type car was able to travel distance of Poso to Palu for 5-6 hours.

Table 1: Commodity Selling Price according to Province Location

No	Province	Price (IDR)/kg	Notes
1	South Sulawesi	700.000	Glass eels death at destination point was borne by sender
2	Bali	950.000	
3	Surabaya	1.125.000	
4	DKI Jakarta	1.150.000	

3.1.3. Glass Eel Trade Prices at Local Collector, Provincial Collectors and Collectors Outside Province

The average commodity price of glass eel at the fisherman's level are IDR 134.000,- per kilogram. Local collectors sell to the provincial collector merchants at an average price of IDR 300.000,- per kilogram. Provincial collectors sell to collectors outside the Central Sulawesi province. The selling price depends on the distance of the buyer's location and transportation mode which commonly used airplane. While local collector merchant on the first supply chain purchases glass eels from fishermen by IDR 150.000,- per kilogram and sell them to the end-buyers at average of IDR 400.000,, per kilogram in Sulawesi island area such as South Sulawesi, West Sulawesi and Gorontalo. The selling price of glass eels commodities that sold outside the Central Sulawesi province is presented in Table 1.

3.1.4. Local and Provincial Collector Merchant

Local collector merchants are the actors who purchase glass eels from fishermen which is then distributed to provincial collector merchants. Provincial collector merchants only purchases glass eel from local collector merchants. Glass eel is transported to the Palu City, capitol of Sulawesi Tengah province by An SUV or van type car. Glass eel were accommodated for 2-3 days in fiber glass. Provincial collector merchants provide packaging treatment to the commodity before being sent outside the province To prevent mortality, glass eel were provided with aeration. These treatment were given to glass eels which was distributed outside the province. Several packaging treatment on glass eel are given including the provision of plastic bags, water, O₂, Styrofoam boxes, ice and cardboard boxes. Glass eel were packed into a plastic bag by total 0.5 kg (2,500-3000 individuals). Prior to the shipping, the inspection was conducted in fish quarantine hall at Mutiara SIS Aldjufri Palu Airport. The examination was performed by taking samples of glass eel.

3.1.5. Glass Eel's Supply Chain

Glass eel's supply chain is a supply chain with living commodity which require special treatment to keep the commodities alive from the fishermen to consumers. Good packaging treatment on glass eel are given including the provision of plastic bags, water, O₂, Styrofoam boxes, ice and cardboard boxes. Glass eel were packed into a plastic bag by total 0.5 kg (2,500-3000 individuals). These treatments are given to prevent the risk of death during land transportation (from glass eel storage location to the province) and aircraft transportation into the delivery destination.

3.2. Supply Chain

Supply chains are network of interconnected and interdependent organizations to work together improving the flow of materials and information from suppliers to end users [8]. Management of activities in order to obtain raw materials into processed goods or intermediate goods and finished goods and then send the product to the consumer through a distribution system are referred as supply chain management [17].

Supply chains of glass eel are involving fishermen, local collector merchant, provincial collector merchant, collectors outside the province and end consumers. The interaction between glass eel distributors create a supply chain which distributes products from production centre to consumer centre.

The supply chain of glass eel in Poso Regency, Central Sulawesi is divided into 2, namely: (1) From fisherman to local collector and then to end consumers; (2) From fishermen to local collector merchant, then goes to provincial collectors merchant and then to collectors outside the province and to end consumers. The supply chain of glass eel is shown in Figure 3.

The supply chain for glass eel can be categorized as simple but relatively difficult because the commodities are still alive and in a very small size which is vulnerable to death. In addition, commodity mileage is relatively far between provinces which uses cars and airplanes as transportation mode.

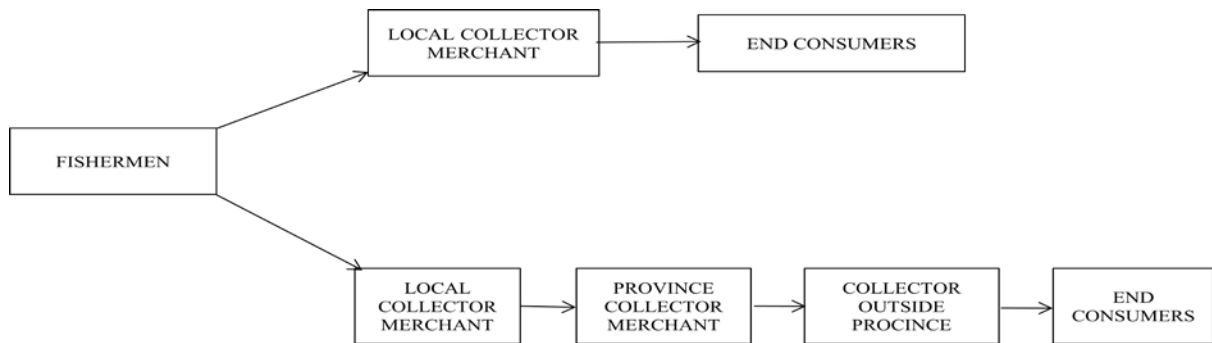


Figure 3: Glass eel supply chain

3.2.1. First Supply Chain

In the first supply chain, glass eels are packaged in Bonesompe Village which is the location of eel fishing ground. Fishermen sell eels to local collector merchant and local collector merchant will sell it directly to final consumers (eel fish farmers) within the island of Sulawesi by land routes with a car. The final consumers are located on Sulawesi Island such as South Sulawesi, West Sulawesi and Gorontalo. The first supply chain flow is shown in Figure 4.



Figure 4: First Supply Chain of Glass Eel

3.2.2. Second Supply Chain

In the second supply chain, the distribution of glass eel commodity starts from fishermen in Bonesompe Village. Then, local collector merchant purchases glass eels from fishermen. After that, provincial collector merchant purchases glass eel from local collector merchant. Glass eel are then collected in fibreglass before being sold to collectors outside the province for 2-3 days. Provincial collector merchant sell glass eel to outside merchant province such as South Sulawesi, Bali, Surabaya and Jakarta via airplanes. Glass eel will then be distributed to eel farmers (end consumers). The second supply chain flow is shown in Figure 5.

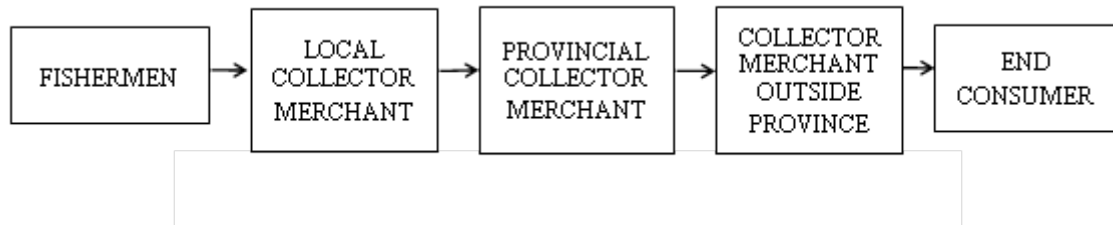


Figure 5: Second supply chain of glass eel

Glass eel package is being transported by the provincial collector merchant to the provincial capital namely Makassar, Bali, Surabaya and Jakarta. Transportation of glass eel package is used by airplane because is relatively far between provinces. Outside merchant province distributed glass eel package to eel farmers (end consumers) by car. Glass eel distribution pattern outside Central Sulawesi at the second supply chain is shown in Figure 6.

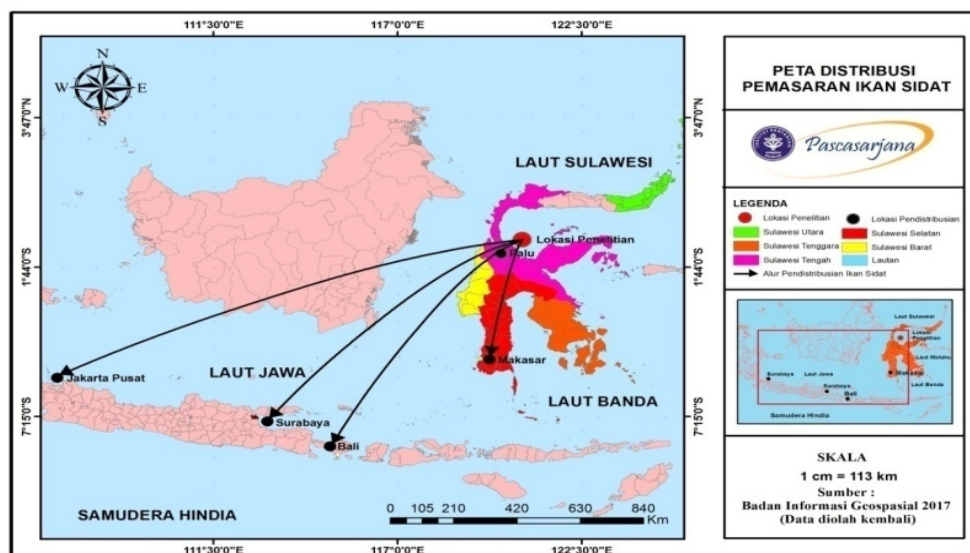


Figure 6: Glass eel distribution pattern outside Central Sulawesi at the second supply chain

3.3. Marketing Efficiency

3.3.1. Fisherman's Share

Fisherman's Share (FS) serves to see how much percentage received by fishermen. Fisherman's Share value is obtained by comparing the price at the fisherman's level with the price at the end-consumer level. The greater Fisherman's Share value, it is better efficient the market performance from the fisherman side.

3.3.1.1. Fisherman's Share of First Supply Chain

Actors in the first supply chain include fishermen, local collector merchant and consumer. Fisherman's share is derived by dividing the prices at fisherman's level and then compared to the price at the consumer level and

multiplied by 100%. Fisherman's Share values in the first market chain are presented in Table 2.

Table 2: Fisherman's Share on the First Chain of Glass Eel Market Chain

Activity	Price (IDR) per kg
	Destination Area
	South Sulawesi, West Sulawesi, Gorontalo
Price at fisherman level	150.000
Purchasing price at consumer level	400.000
Marketing Margin ($MP = Pr - Pf$)	300.000
Fisherman's Share (FS) ($FS = Pf : Pr \times 100 \%$)	37.50

Table 2 shows that the Fishermen Share on the first chain of glass eel is 37.50 %. It was resulted from price fishermen divided price at consumer and multiplied by 100%. The fishermen share was not still an enough to reach the value over 50 %.

3.3.1.2. Fisherman's Share of Second Supply Chain

Actors in the second supply chain include fishermen, local collector merchant, provincial collector merchant, collector merchant outside the province and end consumers. The value of FS in the second supply chain is different from first supply chain. The second supply chain is aimed at collectors outside the Central Sulawesi Province and the final consumer outside Central Sulawesi Province. Fisherman's Share values in of the second supply chain are presented in Table 3. Table 3 shows that the Fishermen Share on the second chain of glass eel is 19.71 % (Makassar) 14.52, (Bali), 12.27 (Surabaya) and 12 % (Jakarta). The values were still low. They were not enough to become compared value of marketing margin (MP). It was resulted from price fishermen divided price at consumer and multiplied by 100%. The fishermen share is the same on the first chain was not still an enough to reach the value over 50 %.

Table 3: Fisherman Share on the Second Glass Eel Supply Chain

Activity	Price (IDR) per kg			
	Destination Area			
	Makassar	Bali	Surabaya	Jakarta
Price at fisherman level	138.000	138.000	138.000	138.000
Price at local collectors	300.000	300.000	300.000	300.000
Purchasing price at consumer level	700.000	950.000	1.125.000	1.150.000
Marketing Margin ($MP = Pr - Pf$)	562.000	812.000	987.000	1.012.000
Fisherman's Share (FS), $Fs = Pf : Pr \times 100 \%$	19.71	14.52	12.27	12

3.3.2. Marketing Margin (MP)

The marketing margin shows the difference between the purchase price at the fisherman's level and the purchase price at the consumer level. It is was obtained by reducing the price at the consumer level with the price at fisherman's level. Marketing margin determined the status of marketing efficiency compared with fisherman share.

3.3.2.1. Marketing Margin at First Supply Chain

Marketing margin shows the price differences at the end-buyer and producer level. Marketing margin at the first supply chain of glass eel is shown in Table 4.

Table 4: Glass eel's Marketing Margin of the first supply chain

Activity	Price (IDR) per kg
	Destination Area
	Makassar, Mamuju, Gorontalo
Price at fisherman level	150.000
Purchasing price at consumer level	400.000
Marketing Margin ($MP = Pr - Pf$)	250.000
% Marketing Margin on selling price	62.5
($\% MP = MP : Pr \times 100 \%$)	

Table 4 shows that marketing margin is Rp 250.000. It was obtained by reducing the price at the consumer level with the price at fisherman's level. The percentage value of marketing margin is 62.5 %. It was obtained from marketing margin is divided by price retailer and multiplied 100 %. It was still higher. It has more 50 %. It can influence status of marketing efficiency compared with Fisherman Share.

3.3.2.2. Marketing Margin at Second Supply Chain

Marketing margins at the second supply chain were obtained from the distribution chain that occurred outside Central Sulawesi, namely to Makassar, Bali, Surabaya and Jakarta. Glass eel's Marketing Margin of second supply chain is shown in Table 5.

Table 5 shows that marketing margin is Rp 562.000.- (Makassar), Rp 812.000.- (Bali), Rp 987.000, (Surabaya) and Rp1.012.000 (Jakarta). It was obtained by reducing the price at the consumer level with the price at fisherman's level. The percentage value of marketing margin is 80.28 % (Makassar), 85.47 % (Bali), 87.73 % (Surabaya and 88 % (Jakarta). It was obtained from marketing margin is divided by price retailer and multiplied 100 %. They were still more 50 % and higher value. They can influence value of marketing efficiency compared fishermen share..

Table 5: Glass eel's Marketing Margin of second supply chain

Activity	Price (IDR) per kg			
	Destination Area			
	Makassar	Bali	Surabaya	Jakarta
Price at fisherman level	138.000	138.000	138.000	138.000
Price at local collectors level	300.000	300.000	300.000	300.000
Purchasing price at consumer level	700.000	950.000	1.125.000	1.150.000
Marketing Margin (MP = Pr - Pf)	562.000	812.000	987.000	1.012.000
% Marketing Margin on selling price	80.28	85.47	87.73	88
(% MP = MP : Pr X 100 %)				

3.3. Efficiency Marketing

A marketing is said to be efficient if the farmer's share (FS) is greater than the marketing margin (MP), $FS > MP$ [2]. FS can be obtained by comparing farmer-level price with consumer-level price [2]. If the value of the farmer's share is equal to the value of the marketing margin, then it is called neutral. If the value of a farmer's share is lower than the marketing margin, then the marketing it is called to be inefficient. Marketing efficiency of first glass eel's supply chain is presented in Table 6.

Table 6: Marketing efficiency on first glass eel supply chain

Activity	Price (IDR) per kg
	Destination Area
	Makassar, Mamuju, Gorontalo
Price at fisherman level	150.000
Purchasing price at consumer level	400.000
Marketing Margin (MP = Pr - Pf)	250.000
% Marketing Margin on selling price	62.50
(% MP = MP : Pr X 100 %)	
Fisherman Share (FS)	37.50
(FS = Pf : Pr X 100 %)	
Efficiency Criteria : Not Efficient because	FS < MP
FS value is smaller than MP value	

Table 6 shows that the percentage value of marketing margin is 62.50 % and fisherman share is 37.50 %. [2] reference to the criteria that marketing efficiency is said efficient if value of prosentage fisherman share is greater than marketing margin (**FS>MP**). In the first supply chain, the fishermen share was 37.50% and marketing margin was 62.50%.

Marketing efficiency on the second supply chain of glass eel involved marketing actors of glass eel from fishermen, local collector merchant, provincial collectors, collectors outside provincial and end-buyers. The efficiency value at the second supply chain is presented in Table 7.

Table 7: Marketing efficiency of the second glass eel's supply chain

Activity	Price (IDR) per kg			
	Destination Area			
	Makassar	Bali	Surabaya	Jakarta
Price at fisherman level	138.000	138.000	138.000	138.000
Price at local collector	300.000	300.000	300.000	300.000
Purchasing price at consumer level	700.000	950.000	1.125.000	1.150.000
Marketing Margin (MP = Pr - Pf)	562.000	812.000	987.000	1.012.000
% Marketing Margin on selling price	80.28	85.47	87.73	88
(% MP = MP : Pr X 100 %)				
Fisherman Share (FS), Fs = Pf : Pr X 100 %	19.71	14.52	12.27	12
Efficiency Criteria : Not Efficient because FS value is smaller than MP value	FS < MP	FS < MP	FS < MP	FS < MP

Table 7 shows that each fisherman's share from various marketing area are namely : Makassar 19.71%, Bali 14.52%, Surabaya 12.27% and Jakarta 12%. While the value of marketing margin in Makassar are 80.28%, Bali 85.47%, Surabaya 87.73% and Jakarta 88%.

4. Discussion

Supply chains of glass eel involved fishermen, local collectors, provincial collectors, collectors outside the province and consumers. The interaction among actors of glass eel distribution creates a supply chain that distributes products from production centers to consumer centers. Based on the result that there are 2 (two) supply chains of glass eel catch in Poso Regency of Central Sulawesi, namely: (1) From fisherman to local collector to end-buyer consumer; (2) From fishermen to local collector traders to provincial collectors to the collector merchants outside the province and finally to the end-buyer consumer. Glass eel supply chain is presented in Figure 3. The supply chain that occurs in glass eel are simple but relatively difficult due to commodity still a live and the small-sized vulnerable to death. In addition, commodity mileage was relatively

far between provinces and uses the transportation mode of cars and airplanes.

In the first supply chain, glass eel commodity flow is started from the fishermen. It is then sold to local collectors. With relatively limited capital capability, local collector/traders sell their products to provincial traders in Sulawesi Island such as South Sulawesi, West Sulawesi and Gorontalo. Local collectors sell their products directly to final consumers (eel farmers). The distribution channel of glass eel market chain is presented in Figure 4.

In the second supply chain, fishermen sell glass eels to local collectors merchant. Local collectors sell to provincial collectors at Poso Regency shelter. Provincial collectors transport products to the provincial capital and accommodate in fiber glass for 2 days. Provincial collectors sell their commodity to collector merchant outside the province in South Sulawesi, Bali, Surabaya (East Java) and DKI Jakarta provinces. Airplane is used to send the commodity with shipping cost presented in Table 1. The second supply chain distribution channel is shown in Figure 5.

Some research results indicated that there were various supply chain of fishery products ranging from one supply chain to 4 supply chain. [19] showed that the lobster supply chain in Simeulue Regency consists of one chain namely fishermen/cultivators (100%) → suppliers (100%) → exporters (90%) and local consumers (10%) → overseas consumers (100%). [4] reported that there are two supply chain of Fish Catch in South Barito Regency, namely Barito River and its surroundings. Both of the channels have different members with different values as well. Channel 1. Fishermen → Collectors → PPI Buntok → Retailer → End Consumer. Channel 2: Fishermen → Collectors → Big Merchants Banjar → Banjar Retailers → End Consumers.

Reference [5] reported that the Skipjack market chain in Ambon was identified to be consisted of three channels, namely (a) channels from fishermen → collector traders → retailers; (b) channel from fishermen → collector trader → smoked fish processor, (c) channel from fisherman → UPI / cold storage. [18] showed that there were 3 (three) supply chain of *mujair* fish (Tilapia fish) in Eris Sub-district of Minahasa Regency, namely: (1) Cultivators of Tilapia fish → Restaurant Industry, (2) Cultivators of Tilapia fish → Large Traders → Retail Traders → Consumers, (3) Cultivators of Tilapia fish → Consumers. Reference [6] showed that there were four supply chains in Puger Jember traditional fishermen, namely (1) Fishermen → Wholesaler → Shipper → Local Consumer. (2) Fishermen → Wholesaler → Shipper → [local, Shipper, Fish Processor → Exporter → Abroad Consumer. [15] showed that lemuru fish landed from the fishing port of Muncar Banyuwangi was distributed to three types of fish processing industries. This distribution was in accordance with the quality level or grade of fish quality: 54% for fish canning, 24% for cold storage industry and 22% for flour and fish oil industry. [12] showed that performance of supply chain of the fishermen and the company shows very good performance and because the company implements order system and focus on one commodity. [9] showed that there were 4 (four) supply chains of fishermen group in Bitung City, namely: (1) Fisherman → End-buyer (2), Fisherman → Calaca Fish Auction → Fish Fishing Company, (3) Fisherman → Fish Collector → Traditional Market → End Buyers, (4) Fishermen → Traditional Markets → Final Buyers.

Supply chain of fishery products showed the products flow from production centers to the consumer center. The flow of fishery products involves institutions that facilitate the products distribution from producers to consumers. Glass eel products have special characteristics as a living product. The treatment should also be specific to distribute the commodity from fishing operation in the river until it is received by end-consumer in its cultivation media. Glass eel needs special handling, packaging, transportation and good quality shelter to keep it alive and fresh.

Various supply chains took place in the fishery products supply chain. A single supply chain channel occurred by fishermen group in Bitung City. Supply chain with a single channel is called a zero level channel. Single channel supply chain also occurred in lobster supply chain in Simeulue Regency, Aceh, while Two-channel of supply chain occurred on fish in South Barito Regency. Three channel of Supply chain occurred in the marketing of skipjack tuna in Ambon. Supply chain with 4 streams occurred on the supply chain on traditional Puger Jember fishermen and supply chain catches of fishermen group in Bitung City.

Efficiency Marketing Analysis

A marketing is said to be efficient if the farmer's share (FS) is greater than the marketing margin (MP), $FS > MP$ [2]. FS can be obtained by comparing farmer-level price with consumer-level price [2]. If the value of the farmer's share is equal to the value of the marketing margin, then it is called neutral. If the value of a farmer's share is lower than the marketing margin, then the marketing it is called to be inefficient. Marketing efficiency of first glass eel's supply chain is presented in Table 6. Table 6 shows that the percentage value of marketing margin is 62.50 % and fisherman share is 37.50 %. Reference [2] to the criteria that marketing efficiency is said efficient if value of prosentage fisherman share is greater than marketing margin (**FS>MP**). In the first supply chain, the fishermen share was 37.50% and marketing margin was 62.50%. By comparing the value of fisherman share (37.50%) and marketing margin (62.50 %). It can be concluded that first supply chain is categorised as inefficient due to $FS < MP$.

Marketing efficiency on the second supply chain of glass eel involved marketing actors of glass eel from fishermen, local collector merchant, provincial collectors, collectors outside provincial and end-buyers. Table 7 shows that each Fisherman's Share from various marketing area are namely : Makassar 19.71%, Bali 14.52%, Surabaya 12.27% and Jakarta 12%. While the value of marketing margin (MP) in Makassar are 80.28%, Bali 85.47%, Surabaya 87.73% and Jakarta 88%. By comparing to the value of Fshermen Share and Marketing Margin, the result showed that the second market chain can be concluded that second supply chain is also categorized as inefficient since the value of fisherman's share is lower than marketing margin ($FS < MP$).

5. Conclusion and Recommendation

Based on the research result, it can be concluded that the glass eel commodity has 2 (two) supply chain distribution, namely : (1) from fisherman to local collector merchant and then to end consumer; (2) From fishermen to local collector merchant to provincial collector merchant, to collector merchant outside the province and to end consumers. Marketing efficiency of supply chain of glass eel in the first and second chains

were inefficient as the fisherman share value are less than the marketing margin ($FS < MP$).

It is necessary to optimize the use of fyke net, regulation on setting activity of fishing gear at Poso River estuary and improvement of the storage for glass eels at Poso River estuary. It is necessary to provide facility to conduct transactions between fishermen and merchant collectors near to fishing location of glass eel to obtain the data related to glass eel production, fisherman, collector merchant, packaging and transportation of glass eel commodity. It is necessary to regulate the selling price of glass eel at the fishermen level, local collectors, provincial collectors and final consumers so that fisherman share value is higher or equal to the marketing margin value ($FS \geq MP$). It is necessary to trace the existence of glass eel commodity and the price fixing of glass eel for collector merchant outside the province and the end consumer (eel farmer).

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